National Park Service - Southwest Alaska Network
Inventory & Monitoring Program

SUMMARY

Coastal Monitoring - Scoping Workshop
Southwest Alaska Network
Seward, Alaska
August 26-28, 2002

Compliled by: Alan Bennett, Dorothy Mortenson, and Page Spencer

The Southwest Alaska Network (SWAN) held a coastal monitoring scoping workshop in Seward August 26-28, 2002 (participants list and agenda attached). Workshop participants were mailed a workshop notebook containing network goals, conceptual models, maps, ecological profiles of park units, and other background information one month before the workshop. The workshop convened on the evening of August 26 for an introductory session in the Kenai Fjords Natural Resources Office and continued the next two days onboard the M/V Serac at anchor in Aialik Bay.

INTRODUCTORY SESSION

Sara Wesser, Regional Inventory and Monitoring (I&M) Coordinator- explained the rationale behind the National I&M Program and described the four Alaskan networks and how they are organized with a Board of Directors and Technical Committee. Sara pointed out that the overall purpose of monitoring in Alaska Parks is to better understand ecosystems but with an eye for management relevance. She also pointed out the opportunity this program provides to be consistent throughout the state.

Alan Bennett, Southwest Network Coordinator- expanded upon information provided in the notebook and provided workshop participants with an overview of what an operational coastal nearshore monitoring program might look like in this network. He provided hypothetical examples of how monitoring might be accomplished and by whom, funding limitations, sampling design considerations, and how the information might be used to improve the way park management decisions are made.

Vernon Byrd, U.S. Fish and Wildlife Service (FWS)- stated that his agency is launching a similar long-term monitoring program and emphasized the importance of getting dedicated money for monitoring and standardizing the way monitoring is conducted. Vernon pointed to the difference between inventory and monitoring and suggested that inventories can prove to be overly "ambitious" if not carefully focused. In effect, inventory is another term for baseline information.

Vernon recommended using existing FWS plans, such as the North American Bird Conservation Initiative (Partners in Flight, Colonial Waterbird, Shorebird, and North American Waterfowl Management Plan), Marine Mammal Management Plans, Endangered Species Recovery Plans, and other documents written by species group experts for guidance on priorities and monitoring methods

He suggested that we consider separating human vs. ecological monitoring with separate tracks for each. In his experience, managers often have the misconception that monitoring means "everything all the time everywhere." This obviously cannot be done, so we need to know what our targets are. Targets depend on objectives such as those that involve measurement of processes, reproductive success, and population size. A selling point for managers is partnerships with other agencies, and working collectively under a broader set of goals (eg. Coastline of Alaska).

He recommended that NPS-Alaska networks think about designing their programs together and try to collectively combine efforts in figuring out what it is that we need to monitor. This extends to partnerships with other agencies as well, for example having FWS do one aspect while NPS does

another. He pointed to some interagency partnership efforts that have already been accomplished, such as aggregated shorebird plans and the identification of high priority species

With reference to probability-based sampling, Vernon cautioned that using random plots might not be advisable. Instead, have some ideas of ways to stratify at a subjective level, then build a sampling design around them. Don't forget to continually ask why you are doing things a certain way. He emphasized that goals and objectives have to be specific and be measurable and that sampling design be sensitive enough to answer specific questions. Be sure to specify the amount of change you want to be able to detect and do power analyses to determine necessary sampling effort. A feedback loop is important to be sure results are adequate for your needs. He expressed interest in how our databases will be designed and reiterated of the importance of standards, format, and analysis.

Carl Schoch, Kachemak Bay Estuarine Research Reserve- commented on the amazing opportunity this program presents to look at issues at different spatial scales across the Gulf of Alaska. Citing the example of coastal systems being connected by currents, he stressed that we need to look at monitoring from a regional scale and pointed to the value of including Wrangells-St Elias NP&P and Glacier Bay NP&P even though they are not in the SWAN.

He stressed the importance of standard protocols and the need to adopt them early. He cautioned against collecting data for "datas sake" and stressed the importance of preparing adequately to sort out the questions. He emphasized the need to study processes responsible for change as well as patterns of change

He expressed fear concerning the longevity of monitoring and contended that to "sell" the program to managers and general public alike, it needs to be linked to something that has "appeal" or interest such as a political or charismatic species. Concern was also expressed in the ability to detect change in the dynamic nearshore environment and ability of NPS to attract and retain expertise needed to operate the program.

Carl emphasized the importance of process-oriented studies and how they can provide the link between pattern and mechanism so change can be evaluated for ecological significance. Equally important are data synthesis and the need to plan this right up front. No data collection should be undertaken until you know what the numbers will mean. He identified other Gulf of Alaska programs that might interface with our network program such as Gulf Ecosystem Monitoring, National Database Center, and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO). Finally, he suggested outreach and the need to get interpretive information out using public use facilities such as tour boats and state ferries.

Pete Peterson, University of North Carolina- stated that the workshop notebook is good and that we "should be able to do it" *referring to our plan for monitoring park coastlines*. He reflected on the fact that shoreline communities are very different and that it is important to know what is truly special about resources in the parks. For example,
KEFJ – Glaciers
LACL – mud flats, birds
KATM – bears need to come high on the list, mussels, clams, etc.

He expressed concern about data that is collected but not analyzed, interpreted, or used and about changes manifested by agents such as disease and parasites that are extremely complex and expensive to detect. On the other hand, he was optimistic that this program can partner with or buy a seat at the table with other larger entities capable of addressing such issues. He cited examples such as the North Pacific Research Board and relying on the GEM program to cover climatic issues, provided that they meet our objectives and needs. He recommends that we define monitoring broadly and include monitoring as a follow up to management actions.

SESSION 1. Conceptual Models

Discussions in this session centered on improving draft models included in the notebooks. General recommendations included where to revise the pictorial background maps to include Kodiak Island, Aniakchak, and major cities and villages; provide more text to go with the illustrations; and exercise caution with the sizes of icons because they imply order of magnitude.

Physical Forces and Energy Flow- Specific recommendations included changing title to Physical Forces and Materials Flow; removing trophic interaction inset; adding Aleutian low in the Gulf of Alaska, icefow and anchor ice in Cook Inlet, mesoscale edies, and atmospheric transport. Improve on the depiction of surface runoff from glaciers, attributes of climate, and transport of Cook Inlet sediments south of Cape Douglas.

Human Activities- Recommendations included using line/arrow width to weight effects; add climate change, mining, subsistence harvest, animal habituation; and change atmospheric deposition to atmospheric pollution. Terms used in "consequences" inset will be modified to correspond, where possible, to titles used in freshwater human effects model.

Trophic Interactions- Notebook draft rejected in favor of an alternative model received from Pete Peterson (Figure 1).

Habitat Typology- Notebook draft was modified during the workshop by Carl Schoch (Figure 2).

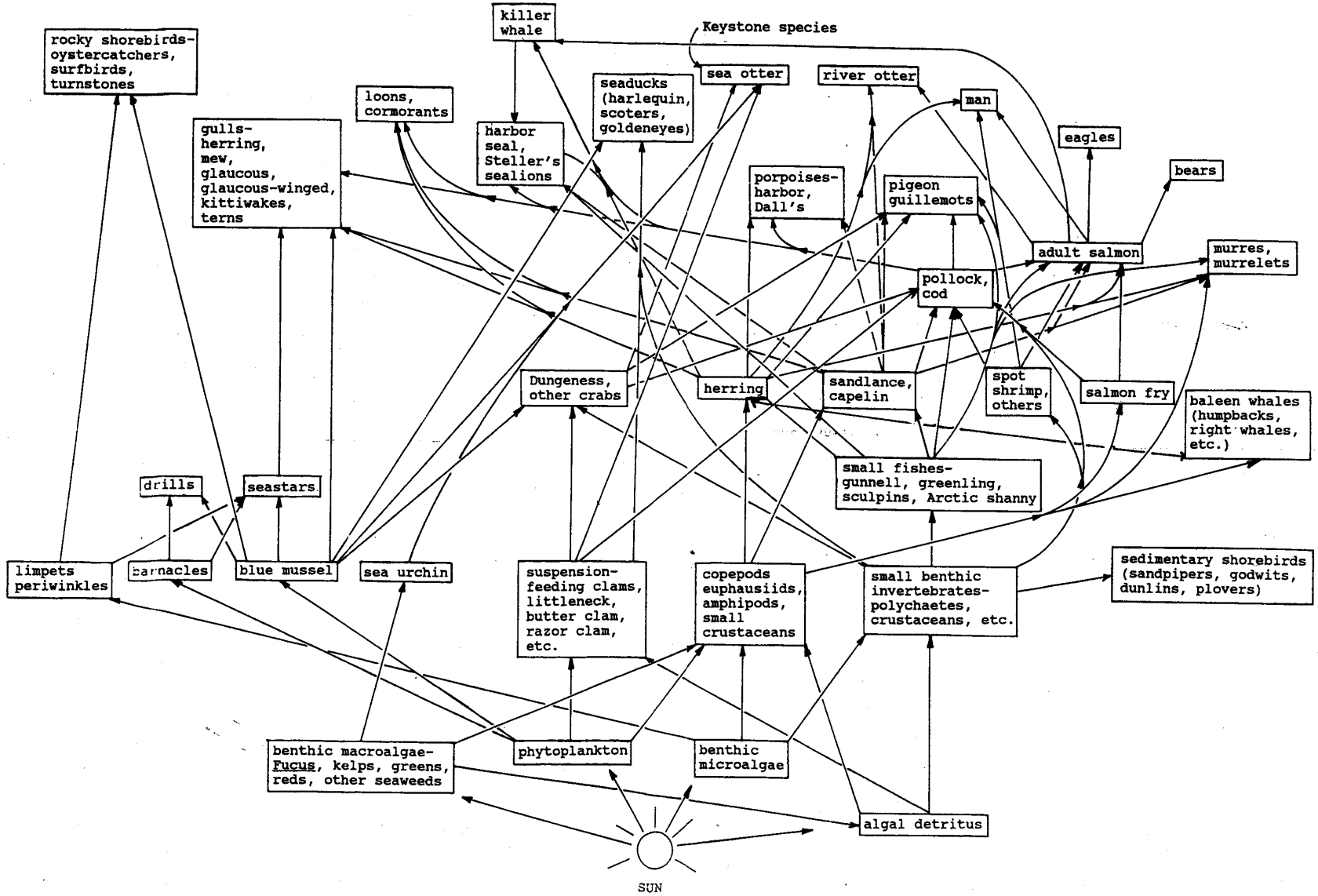

Figure 1. Trophic Interactions. Simplified representation of major linkages between trophic groups in SWAN nearshore coastal ecosystems.

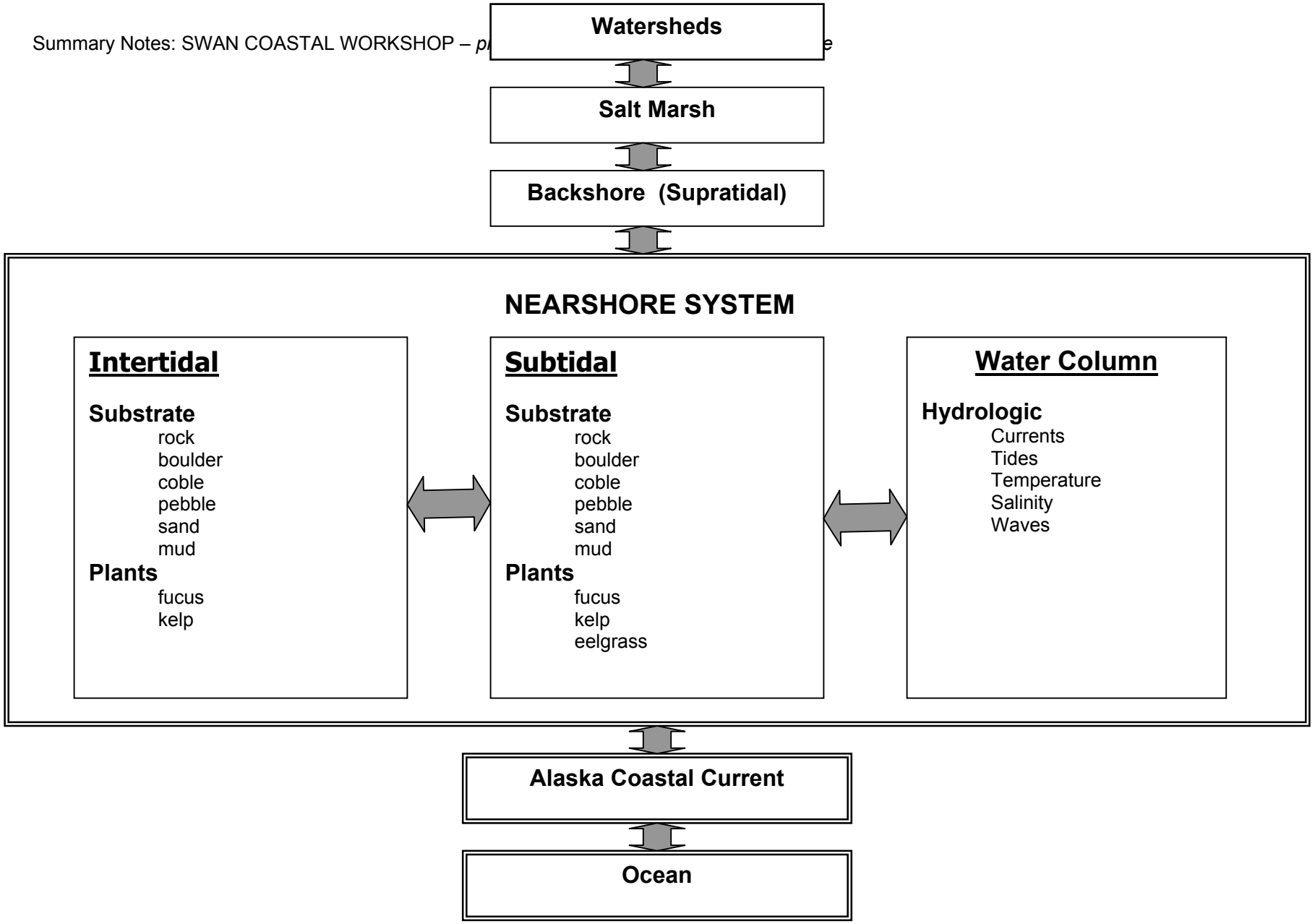

Figure 2. SWAN Coastal Habitats. In addition to energy flow and trophic interactions, coastal ecosystems can be characterized by defining habitats. Habitats are the elements of an environment that sustain an organism or a specific community of organisms. Energy can be transferred among habitats by physical movement of the water, or by movement of organisms between habitats. The interaction among habitats is partly responsible for maintaining trophic structure and productivity of the nearshore.

SESSIONS 2-3
Nearshore Agents of Change and Candidate Attributes to Monitor

Discussions in this session were organized by coastal subsystems defined in the habitat typology model developed during Session 1. Workshop participants initially established a common definition of the subsystem (habitat). Subsequently, participants characterized important ecological features, agents of change, and ultimately candidate physical and biological attributes or variables to monitor. Two additional categories: "PROCESSES THAT MAINTAIN COMMUNITIES" and "MONITORING QUESTIONS" were not addressed during the workshop and need further development. Human activities and core physical parameters were discussed separately because they have broad application across network ecosystems.

NEARSHORE COMMUNITY: Backshore (Supratidal)

DEFINITION:
Zone that extends landward from the higher high water line, or "spray zone" influenced by storm tides.

CHARACTERISTICS:
- Changes seasonally and has a winter renewal cycle.
- Keeper beaches that collect and retain marine debris

ECOLOGICAL IMPORTANCE:
- Catchment basins – area where oil, logs, garbage and other debris strand
- Fringe environment between terrestrial and marine
- Indicator of sea level change
- Infaunal and epifaunal production
- Foraging area for terrestrial scavengers, such as fox, bald eagles
- Movement corridor for animals
- Transports pollutants onshore and up through trophic levels
- Tansports marine nutrients on shore (kelp, feces from birds, etc)
- Mediates energy from storms
- Nesting for bald eagles, shorebirds, waterfowl and seabirds
- Haulout for marine mammals
- Sediments source for seaward subsystems

PROCESSES THAT MAINTAIN THE BACKSHORE:
- Dynamics of erosion and deposition of sediment.
- Large woody debris and vegetation contribute to formation and maintenance.
- Subsidence and lift

AGENTS OF CHANGE:
- Storms that transport sediments and configure beaches
- Sea level rise and other element of global climate change
- Tectonics
- Ice
- El Nino

- Oil spills
- Consumptive human uses

MONITORING QUESTIONS:
- How is the position of shorelines changing?
- Hoe do changes in composition, size or productivity of seabird colonies vary among parks that are subject to different levels of vessel traffic or commercial activites such as fishing?
- What is the relationship between human activities on or near the shoreline and the abundance and productivity of species such as black oystercatchers?
- How are the numbers and reproductive performance of seals and sea lions changing at network haulout sites and rookeries with respect to the GOA?
- Are there stranded pockets of relatively unweathered interstitial oil from the 1989 Exxon Valdez spill remaining on beaches and are they becoming less oiled over time?

CANDIDATE ATTRIBUTES TO MONITOR:
- **Shoreline erosion (rate) and substrate composition (beach profile)**
- **Bird numbers/productivity, Bald eagles, Black Oystercatchers, Common Murre, Mew Gull, Black-legged Kittiwake, and Pigeon Gullimot.**
- **Harbor seals and Steller sea lions (haulout sites and rookeries)**
- **Beach debris**
  - **Animal carcass counts (age of specific dead animals)**
  - **Other Debris - annual measurements of the types of debris and quantity of each.**
- **Chronic oil exposure (turnover rates persistence)**

NEARSHORE COMMUNITY: Salt Marsh

DEFINITION:
Intertidal vegetated zone where the upper elevation of occurrence is approximately the highest astronomical tide, while the lower limit is rarely below mean high water neap.

CHARACTERISTICS:
- Dynamic system; high productivity; shaped by the interaction of freshwater, saltwater, sedimentation, and vegetation; widely distributed in the network; sensitive to hydrography and changing environmental conditions

ECOLOGICAL IMPORTANCE:
- Provides a complex of habitats.
- Highly productive – land/sea margin
- Habitat for larval and juvenile fish, waterfowl, wading birds, bears
- Vulnerable to non-native species invasions
- Filter and sink for sediments and pollutants
- Drives nearshore nutrient cycling
- Retains oil following spills
- Transition between saltwater and freshwater

PROCESSES THAT MAINTAIN SALT MARSHES:

- Marshes accrete sediment and organic matter and thereby build land both upward and outward.
- They are maintained by adequate hydrology and sediment supply.
- Salinity affects salt marsh plant species composition and the lower limits of distribution.
- Topographic structure that protects them from high energy waves.

AGENTS OF CHANGE:
- Alterations in sediment supply
- Sea level rise and changes in salinity
- Intensity and frequency of storms
- Ice scouring
- Oil spills
- Tectonic activities (such as earthquakes) more than other natural causes.
- Herbivory
- Invasive species can change the composition resulting in a change of habitat, filtering capabilities, flow of water and related species.
- Local subsidence, and alteration in local sediment supply
- ATV use – as it effects hydrology and salinity

MONITORING QUESTIONS:
- How is the surface elevation of salt marshes rising or sinking relative to sea level?
- Is the linear distance of sloughs changing per unit area of salt marsh and is the configuration of sloughs changing the number or area of tidal ponds?
- Is salt marsh plant species composition changing or are vegetation zones migrating?

CANDIATE ATTRIBUTES TO MONITOR:
- **Surface area and elevation**
- **Drainage patterns and spatial configuration of sloughs**
- **Plant species composition and zonation**

NEARSHORE COMMUNITY: Intertidal

DEFINITION:
Interface between terrestrial, atmosphere and marine. From Mean Low Water (MLW) to Mean High Water (MHW)

CHARACTERISTICS:
- Problematic for long-term monitoring because of the huge gradients within a small space
- Effects are fairly local; variability is on a small scale
- Relatively cheap to sample
- Low zone more productive than high zone
- Questions need to be carefully defined with high sample size
- Important to distinguish between sediment areas and rocky areas because of the high variablity among the two

ECOLOGICAL IMPORTANCE:
- Ecological window into the offshore marine world

- Indicator of change in the ocean, but difficult to know the source of change
- Important feeding grounds for juvenile sea otters, dabbling and diving ducks, harlequin ducks, blue mussels, puffins, oyster catchers, shorebirds, bears, juvenile salmon, etc.
- Staging area for migratory birds and haulout for marine mammals
- High biodiversity
- Spawning area for herring
- High disturbance
- Early colonizer, limited by space
- Generate large amounts of larvae

PROCESSES THAT MAINTAIN THE INTERTIDAL:
- Sediment required to maintain flats is supplied by rivers, streams, and eroding bluffs.
- Nearshore currents and waves, along with river flow dynamics, act in concert to distribute and rework sediments.
- Sediment and substrate composition as well as sediment dynamics exert primary control over the biological community
- Seasonal abundance of algae and invertebrate prey species are influenced by variations in light and temperature
- Detritus sources help maintain levels of organic matter that are an important component of the intertidal and support biotic communities that utilize flats.
- Substrate stability, tides, and wave action
- Larval supply
- Predation/competition which structures communities

AGENTS OF CHANGE:
- Oil spills and other contaminants
- Alterations in salinity, temperature, sediment and tidal dynamics
- Tectonic activities such as earthquakes
- Herbivory
- Biotic interactions
- Invasive non-native species
- Overwater structures
- Abrasion/crushing by logs and ice

MONITORING QUESTIONS:
- How does intertidal community structure (species composition and relative abundance) vary over time and how do these changes relate to temporal changes in climate and coastal oceanographic conditions?
- What is the degree to which toxins ingested by benthic invertebrates are transferred up the food chain in a form that can affect reproduction, growth, or survival of vertebrate consumers of those benthic prey?

CANDIDATE ATTRIBUTES TO MONITOR:
- **Rocky intertidal invertebrate and macrophyte species richness and relative abundance**

- **Soft sediment infauna community structure, diversity and abundance; especially mussels and bivalves such as Macoma that are key prey species for higher trophic predators**
- **Forage fish, especially herring, caplin, and sand lance**
- **Shorebird/prey interactions on soft sediments**
- **Organic contaminants in animal tissues and sediments**

POTENTIAL PARTNERS:
- ADF&G - Razor clams
- EVOS – Forage fish
- PISCO – Rocky Intertidal
- EPA and CIRCAC– Mussel and sediment contaminants

NEARSHORE COMMUNITY: Subtidal Benthos

DEFINITION: Substrate extending from mean low water seaward to a depth of 30 meters (outer edge of macrophyte plants such as kelp and seagrass)

CHARACTERISTICS:
- Areas with kelp and seagrass
- "Aesthetic" coastal area that receives high human use
- Transition zone between nearshore and coastal current

ECOLOGICAL IMPORTANCE:
- High primary and secondary productivity and high biodiversity
- Rearing ground for marine animals (herring, salmon, caplin, pollock, rockfish, crab, invertebrates)
- Foraging area for diving and sea ducks, river otters, sea otters, and Pigeon guillemots
- Kelp/Seagrasses beds that serves as a nutrient filter, provides understory and ground cover, physical substrate for planktivorous fish, clams, urchins, and invertebrates

PROCESSES THAT MAINTAIN THE SUBTIDAL:
- Downstream sediment transport and freshwater discharge
- Freshwater and saltwater stratification
- Light, temperature, and salinity
- Substrata, nutrients, and water motion

AGENTS OF CHANGE:
- Storms that tear up the bottom and disperse spores and larvae
- El Nino – depth mixing
- Herbivory and predation (helmet crabs, urchins)
- Commercial fishing and aquaculture – depletion of species and introduction of disease

MONITORING QUESTIONS:

- What role does the input of fresh water along the coastline play in supplying nutrients and sediments to the subitdal? How is this role affected by varying ocean climate on seasonal, annual, and longer time scales?
- How do patterns of species diversity vary seasonally and annually in the subtidal with respect to major abiotic factors such as salinity, temperature, depth, current speed and direction, as well as sediment grain size?

CANDIDATE ATTRIBUTES TO MONITOR;
- **Habitat features such as substrate composition, vegetation composition and density**
- **Species richness and community structure**
- **Sea urchins and helmet crabs (relative abundance)**

NEARSHORE COMMUNITY: Water Column

DEFINITION: Zone of water extending from mean low water seaward to a depth of 30 meters (outer edge of macrophyte plants such as kelp and seagrass)

CHARACTERISTICS:

ECOLOGICAL IMPORTANCE:
- Kelp forest/seagrass acts as a filter substrate and alternate habitat for other plants
- Dynamic trophic area in terms of primary and secondary productivity
- Habitat for juvenile rockfish, nursery and spawning for fish, such as herring and sand lance
- Primary feeding zone for nearshore seabirds, nearshore fish and mammals (seals, sea lions, whales)

PROCESSES THAT MAINTAIN THE WATER COLUMN:
- Freshwater and saltwater stratification
- Light, temperature, and salinity
- Nutrients and water motion

AGENTS OF CHANGE:
- Predator/prey balance between sea otters and sea urchins.
- Pollution
- Commercial and sport fishing
- Vessel traffic
- Sea level sea temperature rise
- Storm frequency and intensity
- Suspended sedmients

MONITORING QUESTIONS:
- How do the timing, magnitude, duration, and species composition of the spring bloom respond to seasonal and interannual variability in nutrient supply and physical conditions?
- How do populations and productivity of sea otters fluctuate interannually and interdecadally? Does food supply play the main role, or do disease and predation?.

CANDIDATE ATTRIBUTES TO MONITOR:
- **Chlorophyll, zooplankton, and invertebrate larvae**
- **Kelp Forest and seagrass (canopy extent and density)**
- **Sea otter relative abundance**
- **Forage fish biomass**
- **Water quality parameters (core list)**

Coastal (All Communities) – Human Activities

CONCERNS:
- Potential adverse impacts are relatively great and increasing both spatially and temporally.
- Shifting patterns of human use
- External events are influencing park resources
- Introduction of non-native species

CANDIDATE ATTRIBUTES TO MONITOR: (by park management)
Network
- **Permits issued**
- **Numbers of users and user type**
- **Access parameters**
  - **Distribution and abundance**
  - **How, where, when**
- **Infrastructure – roads, buildings, airstrips,**

Statewide/regional

- Number of visitors to Alaska
- Industry trends
- Resident population trends
- Change in technology, wealth, free time

Coastal (All Communities) – Abiotic Core Parameters

Water Quality Parameters:
- Temperature
- Salinity
- Turbidity
- Dissolved Oxygen
- Inorganic nutrients
- pH
- Chlorophyll

Other Water Column Parameters:

- Sediment Dynamics:
- Current velocity and direction
- Ice scour/anchor ice
- Circulation
- Mixing stratification
- Upwelling centers/ downwelling
- Nutrient sources and sinks
- Wave Dynamics/reflecting
- Long shore currents – sediment transport
- Fronts – estuarine
- Mesoscale eddies – off coastal currents

Climatic Parameters:
- Precipitation volume and chemistry
- Snowmelt
- Wind
- Temperature
- Chemistry
- Atmospheric deposition
- Sea level rise
- Tectonic movements

Physical Habitat Parameters:
Shoreline Classification –
- Adopt Washington State BioPhysical Shore-Zone Mapping System of 34 classes for classifying linear segments with an across-shore description of their form and material.
- Conduct a biophysical inventory of coastlines using a combination of helicopter video and field sampling

Classification parameters:
- **Shore Units** -- Shore units that are defined based on physical morphology (form and material) of the shoreline where unit boundaries identify a change from one physical class to another.
- **Zones -**- Shore units that are divided into three across-shore zones; the backshore, intertidal and sub-tidal. The divisions between these zones are based on physical and biological characteristics within a shore unit that define the landward limit of marine processes, the high water line and the low water line.
- **Components** -- Each zone is divided further across-shore into components based on the material composition and form of the substrate. Primary, secondary and tertiary material and form are described within components and provide descriptors of the variability in geomorphology within a component.
- **Bands -**- Components that are sub-divided into across- shore areas of common species assemblages termed bands. Bands are defined by the dominant cover species and the color and texture of that band visible from aerial videography, photography, or from ground surveys.

- **Species** - Although species data do not at present provide a further sub-division of bands, they are essential for characterizing the species composition within a shore zone, and for assessing the significance of physical boundaries to the distribution of species.

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